Refrigerator

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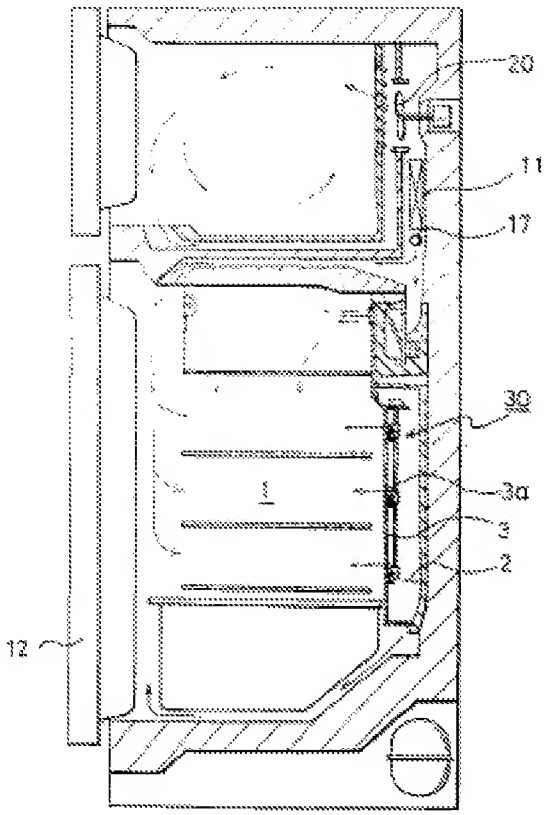
Abstract of **EP0893659**

A refrigerator has a device (30; 50) for opening/closing cool air discharge ports (3a). The device includes plates (43; 52) for opening/closing the ports (3a), and a driving device (34, 35, 36, 38; 54, 56, 58, 59, 60) for driving the plates (43; 52). The heat exchange between an evaporator (11) and the outside warm air is prevented during defrosting and when a door (12) is open. Hence the cooling efficiency is enhanced and the frost caused by the outside warm air is not generated on the evaporator (17).

FIG. 2



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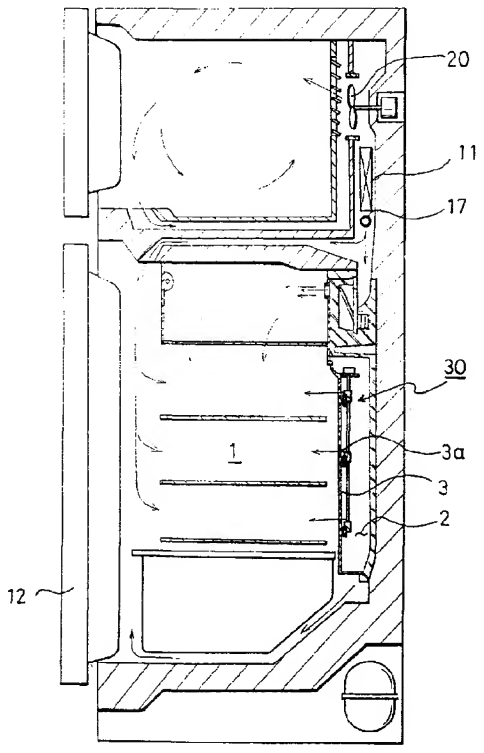
(54) Refrigerator

(57) A refrigerator has a device (30; 50) for opening/closing cool air discharge ports (3a). The device includes plates (43; 52) for opening/closing the ports (3a), and a driving device (34, 35, 36, 38; 54, 56, 58, 59, 60) for driving the plates (43; 52). The heat exchange between an evaporator (11) and the outside warm air is prevented during defrosting and when a door (12) is open. Hence the cooling efficiency is enhanced and the frost caused by the outside warm air is not generated on the evaporator (17).

FIG. 2



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Description

The present invention relates to a refrigerator comprising a cooling compartment, a cooling compartment door, an evaporator in which refrigerant evaporates to produce cooling, an air path for directing cooling air from the evaporator to the cooling compartment, a heater for defrosting the evaporator and control means for controlling the heater.

As shown in Figure 1, a refrigerator has a body 14 defining a freezing compartment 15 and a fresh food compartment 1, first and second doors 16, 12 for opening and closing the freezing compartment 15 and the fresh food compartment 1 respectively, a compressor 19 for compressing refrigerant, an evaporator 11 for generating cool air by evaporating the refrigerant supplied from the compressor 19, and a fan 20 for blowing the cool air generated by the evaporator 11.

A duct member 3 forming a cool air duct 2 is installed at the rear part of the fresh food compartment 1. The duct member 3 has a plurality of cool air discharge ports 3a opening into the fresh food compartment 1. The cool air blown by the fan 20 flows into the cool air duct 2, and is then discharged into the fresh food compartment 1 through the cool air discharge ports 3a. A guide device 13 for guiding the cool air flowing into the cool air duct 2 toward the cool air discharge ports 3a is installed in the cool air duct 2.

While the refrigerator is operating, frost forms on the evaporator 11. The cooling efficiency of the evaporator 11 is lowered by the frost. Hence, the refrigerator is equipped with a heater 17 for removing the frost, and performs a defrosting operation by heating the evaporator 11 using the heater 17 when the refrigerator has been operating for more than a predetermined period of time.

In such a conventional refrigerator, there is a problem that the heat generated by the heater 17 during the defrosting operation is transmitted into the fresh food compartment 1. The heat generated by the heater 17 is mainly transmitted through the path for supplying the cool air. That is, the heat is mainly transmitted to the fresh food compartment 1 through the cool air duct 2 and the cool air discharge ports 3a. Due to the heat transmitted to the fresh food compartment 1, the cooling efficiency of the fresh food compartment 1 is lowered, and the status of the food stored therein cannot be maintained properly.

Furthermore, when a user opens the door 12 of the fresh food compartment 1, the outside warm air flows into the fresh food compartment 1. This mainly flows into the area adjacent to the evaporator 11. When the outside air flows toward the evaporator 11, the amount of frost forming on the evaporator 11 increases. The defrosting operation therefore needs to be performed more frequently. The heater 17 must be operated in order to perform the defrosting operation, so the cooling efficiency is still more lowered by the frequent defrosting.

A refrigeration according to the present invention is characterised by motorised gate means for selectively blocking the air path, the gate means being responsive to a signal from the control means to block the air path when the control means senses that the cooling compartment door is open and/or when the control means energises the heater. There may be a plurality of gate means driving by a common motor.

Preferably, the motorised gate means comprises a closure member pivotable between an air path unblocked position and an air path blocked position. More preferably, the motorised gate means comprises a cam member, having a cam groove, drivingly coupled to a motor, a cam follower means received in the cam groove and an actuator member coupled to the cam follower means for moving the closure member to the air path blocked position in response to the cam member being moved by the motor in a first direction.

Preferably, the air path includes an aperture in a wall between an air duct and the cooling compartment.

In a first preferred embodiment, the actuator member comprises a lever configured to slide the closure member over the aperture to block the air path.

In a second preferred embodiment, the closure member comprises a flap hingedly mounted at the bottom of the aperture, the cam member comprises a cylinder having the cam groove formed in a helix around its curved surface and the actuator member comprises a pot, in which the cam member is located and from which the cam follower projects radially inward, an arm depending from the pot and a finger projecting perpendicularly from the arm, the finger lifting the flap so as to close the aperture when the motor is driven in the first direction.

Embodiments of the present invention will now be described, by way of example, with reference to Figures 2 to 6 of the accompanying drawings, in which:-

Figure 1 is a side sectional view of a prior art refrigerator;

Figure 2 is a side sectional view of a refrigerator according to the present invention;

Figure 3 is an enlarged perspective view of the opening/closing device shown in Figure 2;

Figure 4 is a side sectional view of Figure 3;

Figure 5 is another embodiment of the opening/closing device according to the present invention; and

Figure 6 is a side sectional view of Figure 5.

In the following description, parts common to the refrigerator of Figure 1 and the refrigerators described below will now be described again. However, the same reference numbers will be employed.

Referring to Figures 2, 3 and 4, an opening/closing device 30 for opening/closing the cool air discharge ports 3a is installed in the cool air duct 2.

The opening/closing device 30 includes a driving

motor 34 installed in the cool air duct 2, a plurality of cam cylinders 36 configured for being rotated by the driving motor 34, a plurality of levers 38 configured for being driven by the cam cylinders 36 respectively, and a plurality of plates 43 configured for being operated by respective levers 38.

The cam cylinders 36 are connected to the rotational shaft 35 of the driving motor 34. Each of the cam cylinders 36 is formed with a cam groove 37 on its periphery.

A guide pin 41 is installed at one end of each of the lever 38 and projects into a respective cam groove 37. The other end of each lever 38 is fixed to a respective plate 43. Respective pivot pins 39 are installed at the central parts of respective levers 38. The pivot pins 39 are fixed on the duct member 3 so that the levers 38 are pivotably installed.

Respective spring members 31 for forcing the guide pins 41 into the cam grooves 37 are disposed between each lever 38 and the respective guide pin 41. The guide pins 41 come into elastic contact with the bottoms of the respective cam groove 37, and thereby the operations of the levers 38 are efficiently controlled by the cam cylinders 36.

While the refrigerator is operating, the plates 43 keep the cool air discharge ports 31 open. When the defrosting operation of the refrigerator begins, the driving motor 34 is caused to rotate the cam cylinders 36 by a control part (not shown), whereby the levers 38 pivot. As the levers 38 pivot, the plates 43 close the cool air discharge ports 3a.

During the operation of the refrigerator, when a user opens the door 12, the opening of door 12 is sensed by a sensor for use in sensing the opening/closing of the door 12, and then the control part causes the driving motor 34 to close the cool air discharge ports 3a as described above.

Since the cool air discharge ports 3a are closed during the defrosting operation and/or when the door 12 is open, the transmission of the heat from the heater 17 to the fresh food compartment 1 and the transmission of the outside warm air to the evaporator 11 are prevented. Therefore, the lowering of the cooling efficiency of the fresh food compartment 1 is prevented, and the frost caused by the outside warm air does not grow on the evaporator 11.

Referring to Figures 5 and 6, the opening/closing device 50 includes a driving motor 60 installed in the cool air duct 2, a cam cylinder 58 configured for being rotated by the driving motor 60, a hollow cylinder 56 configured for being driven by the cam cylinder 58, an operation rod 54 installed at the lower side of the hollow cylinder 56, and a plate 52 configured for being operated by the operation rod 54.

The cam cylinder 58 is connected to the rotational shaft of the driving motor 60. A cam groove 57 is formed on the periphery of the cam cylinder 58.

The hollow cylinder 56 is formed to surround the outer side of the cam cylinder 58, and thereby the cam cylinder 58 is substantially accommodated in the hollow cylinder 56. At the inner side of the hollow cylinder 56, a guide protrusion 55 inserted into the cam groove 57 of the cam cylinder 58 protrudes.

The operation rod 54 is fixed by an additional fixing means which is not shown so that it is fixed in a rotational direction and can be moved in vertical direction.

Brackets 62 are formed at both ends of the lower edge of the cool air discharge port 3a, and a hinge pin 61 is fixed by the brackets 62. The plate 52 is hingedly mounted on the edge part of the cool air discharge port 3a by the hinge pin 61.

A support protrusion 54a protrudes from the operation rod 54. The support protrusion 54a supports the plate 52. The plate 52 is supported by the support protrusion 54a so that the cool air discharge port 3a is opened when the operation rod 54 is moved down as shown in Figure 5, and the cool air discharge port 3a is closed when the operation rod 54 is moved up as shown in Figure 6.

The operation of the refrigerator having the opening/closing device according to the present embodiment is similar to that of the embodiment shown in Figures 2 through 4. That is, when the door 12 is opened or the defrosting operation of the evaporator 11 is performed by the heater 17, the driving motor 60 is caused to rotate the cam cylinder 58 by the control part (not shown), and thereby the hollow cylinder 56 and the operation rod 54 move up. Consequently, the cool air discharge ports 3a are closed by the plates 52.

As described above, according to the present invention, since the heat exchange between the evaporator and the outside warm air is prevented during the defrosting operation and when the door is open, the cooling efficiency is enhanced and the frost caused by the outside warm air does not form on the evaporated.

Claims

1. A refrigerator comprising a cooling compartment (1), a cooling compartment door (12), an evaporator (11) in which refrigerant evaporates to produce cooling, an air path (2, 3a) for directing cooling air from the evaporator (11) to the cooling compartment (1), a heater (17) for defrosting the evaporator (11) and control means for controlling the heater, **characterised by** motorised gate means (30; 50) for selectively blocking the air path (2, 3a), the gate means (30; 50) being responsive to a signal from the control means to block the air path (2, 3a) when the control means senses that the cooling compartment door (12) is open and/or when the control means energises the heater (17).

2. A refrigerator according to claim 1, wherein the motorised gate means comprises a closure member

(43; 52) pivotable between an air path unblocked position and an air path blocked position.

3. A refrigerator according to claim 2, wherein the motorised gate means (30;50) comprises a cam member (36; 58), having a cam groove (37;57), drivingly coupled to a motor (34; 60), a cam follower means (41; 55) received in the cam groove (37;57) and an actuator member (38; 54, 56) coupled to the cam follower means (41; 55) for moving the closure member (43; 52) to the air path blocked position in response to the cam member (36; 58) being moved by the motor (34; 60) in a first direction.

4. A refrigerator according to claim 3, wherein the air path (2, 3a) includes an aperture (3a) in a wall (3) between an air duct (2) and the cooling compartment (1).

5. A refrigerator according to claim 4, wherein actuator member (38) comprises a lever (38) configured to slide the closure member over the aperture (3a) to block the air path.

6. A refrigerator according to claim 4, wherein the closure member (52) comprises a flap (52) hingedly mounted at the bottom of the aperture (3a), the cam member (58) comprises a cylinder having the cam groove (57) formed in a helix around its curved surface and the actuator member (38) comprises a pot (56), in which the cam member (58) is located and from which the cam follower projects radially inward, an arm (54) depending from the pot (56) and a finger (54a) projecting perpendicularly from the arm (54), the finger (54a) lifting the flap (52) so as to close the aperture (3a) when the motor is driven in the first direction.

7. A refrigerator comprising:

a body for forming a cooling compartment;
a door for opening/closing said cooling compartment;
an evaporator for generating cool air to be supplied into said cooling compartment by evaporating refrigerant;
a heater for removing frost generated on said evaporator;
a duct member forming a cool air duct for guiding the cool air generated from said evaporator, said duct member being formed with a plurality of cool air discharge ports opened in said cooling compartment; and
an opening/closing device including a driving motor being installed in said cool air duct, a cam member being rotated by said driving motor, a movement means being moved up and down by said cam member, and plates for opening/closing the cool air discharge ports according to an up-and-down movement of said movement means, said opening/closing device for opening/closing the cool air discharge ports during a defrosting operation and/or when said door is open.

8. The refrigerator as claimed in claim 7, wherein said cam member is a cylinder formed with a cam groove on a periphery thereof.

9. The refrigerator as claimed in claim 8, wherein said movement means comprises a lever having a guide pin inserted into the cam groove at one end thereof, said lever of which the other end is fixed with said plate, and a central part is fixed by a pivoting pin, said lever for pivoting said plate when said cam member is rotated.

10. The refrigerator as claimed in claim 9, further comprising a spring member disposed between said lever and said guide pin, said spring member for elastically forcing said guide pin into the cam groove.

11. The refrigerator as claimed in claim 8, wherein said movement means comprises: a hollow cylinder for accommodating said cylinder, said hollow cylinder having a guide protrusion formed on an inner side thereof, said guide protrusion being inserted into the cam groove; and an operation rod being connected to said hollow cylinder.

12. The refrigerator as claimed in claim 11, wherein said plate is hingedly mounted at an edge of the cool air discharge port.

13. The refrigerator as claimed in claim 12, further comprising support protrusions being protruded at a part of said operation rod, said support protrusions for supporting said plates so that said plates open the cool air discharge ports when said operation rod is moved down, and said plates close the cool air discharge ports when said operation rod is moved up.

FIG. 1

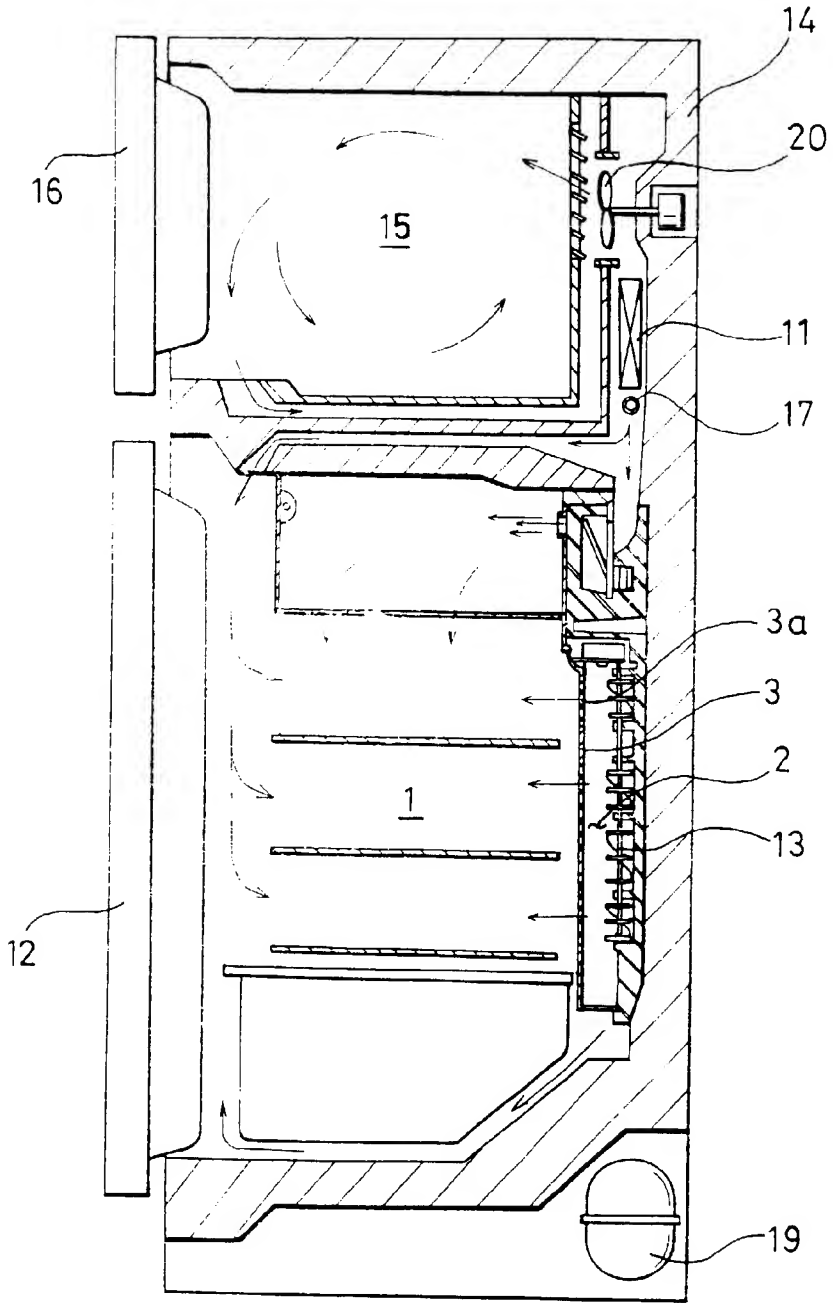


FIG. 2

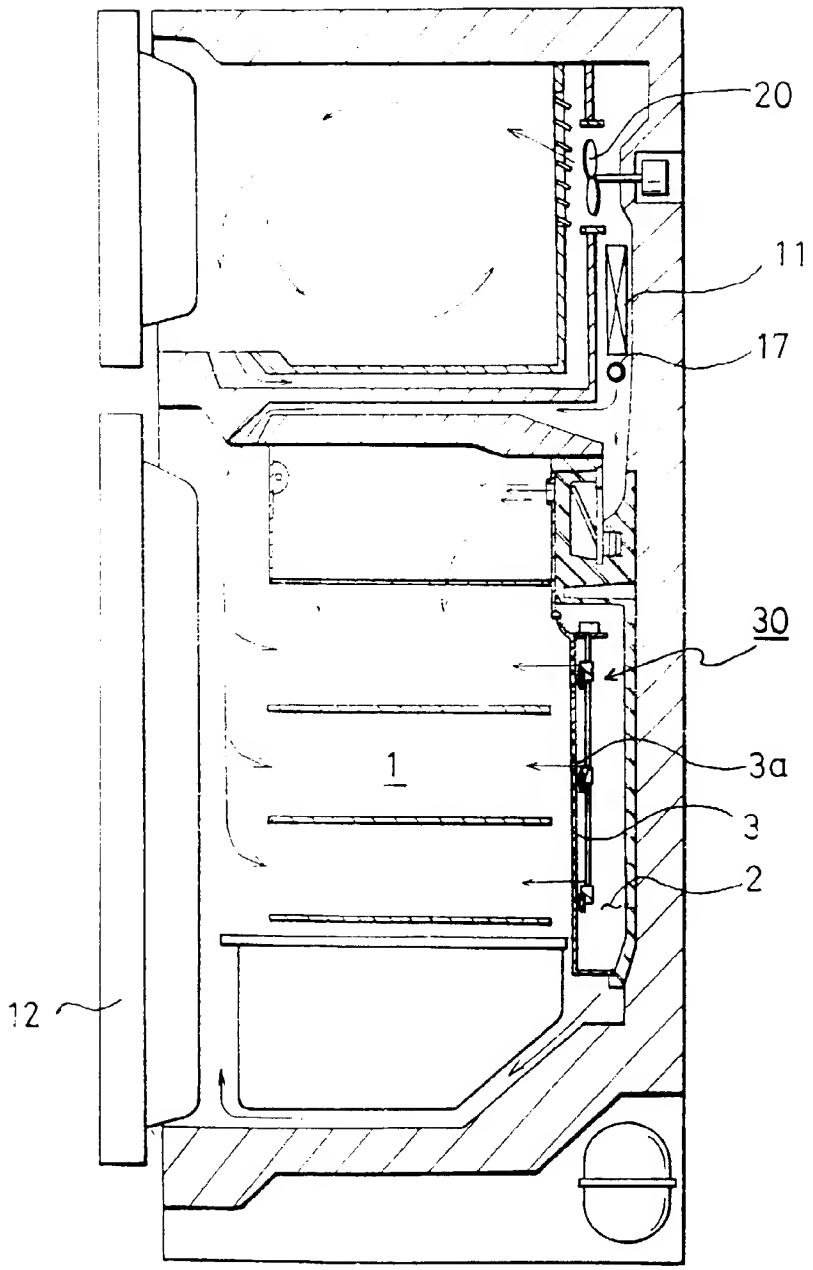


FIG. 3

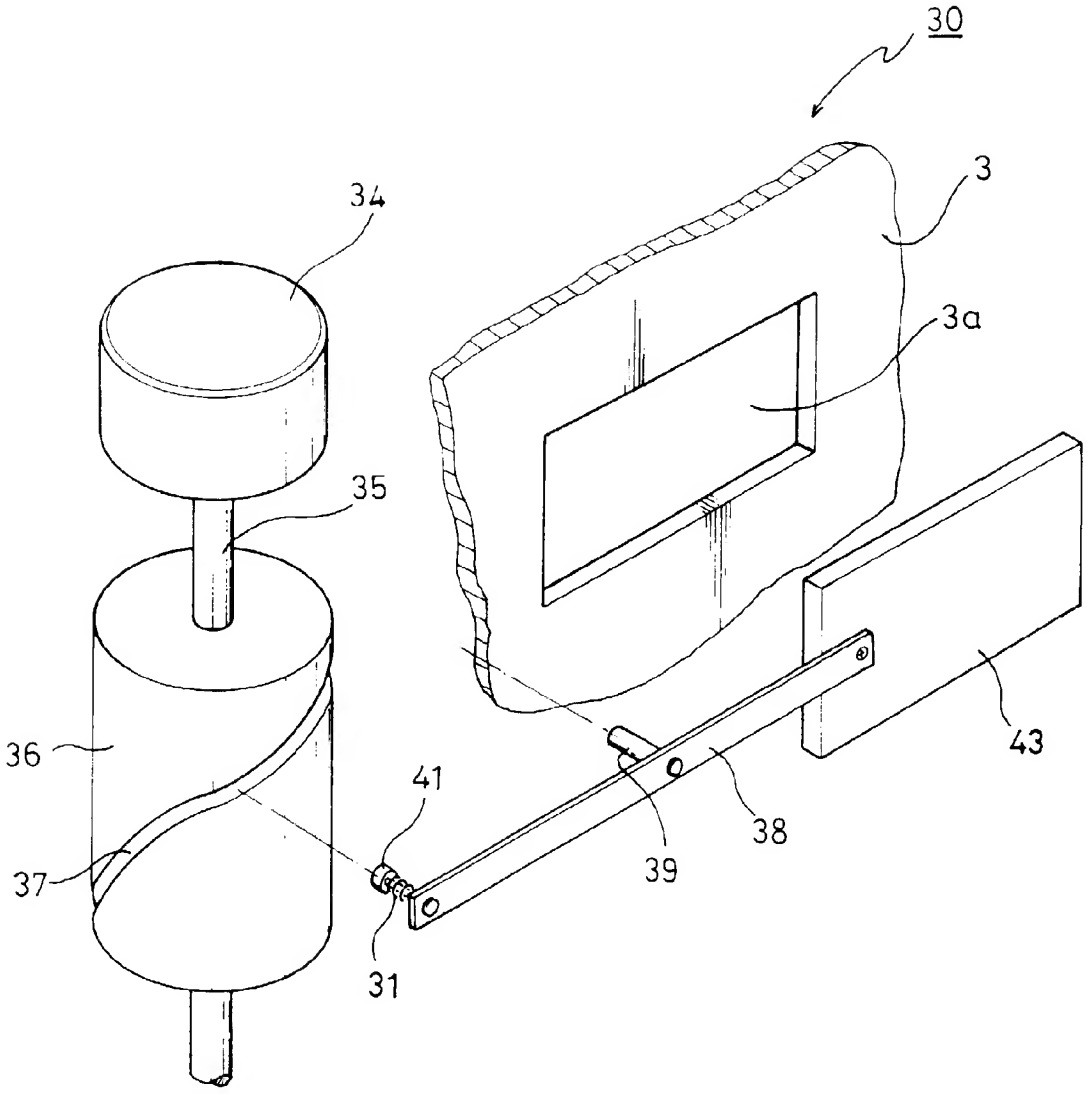
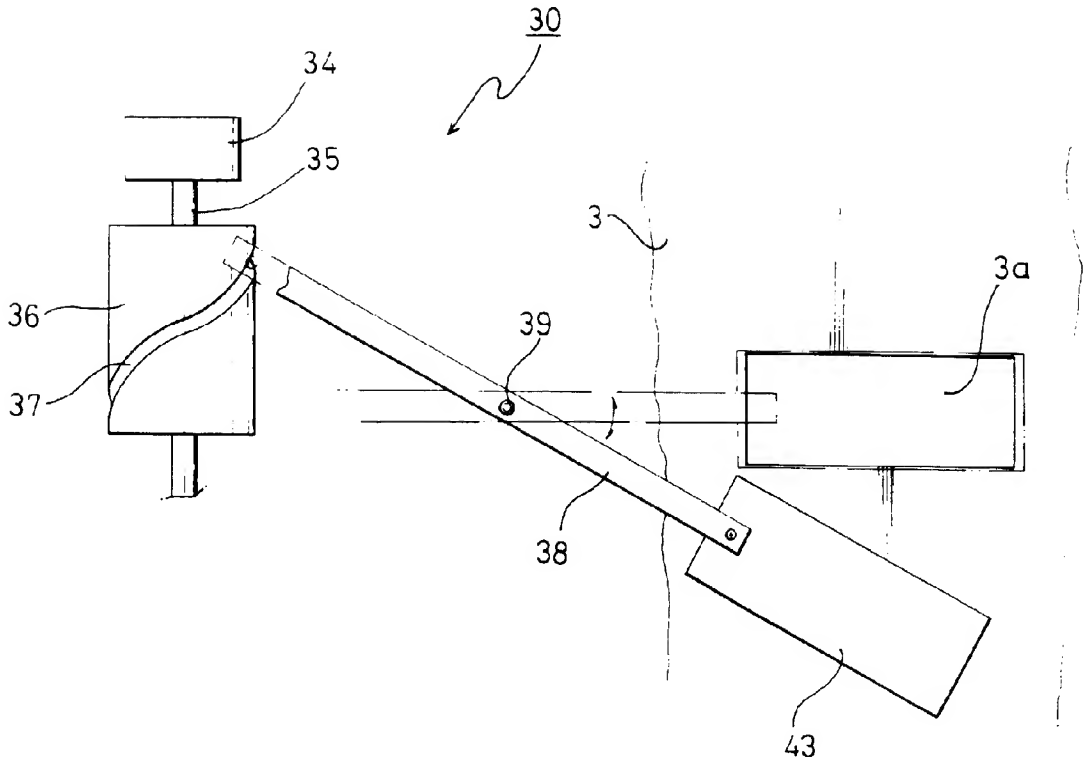


FIG. 4



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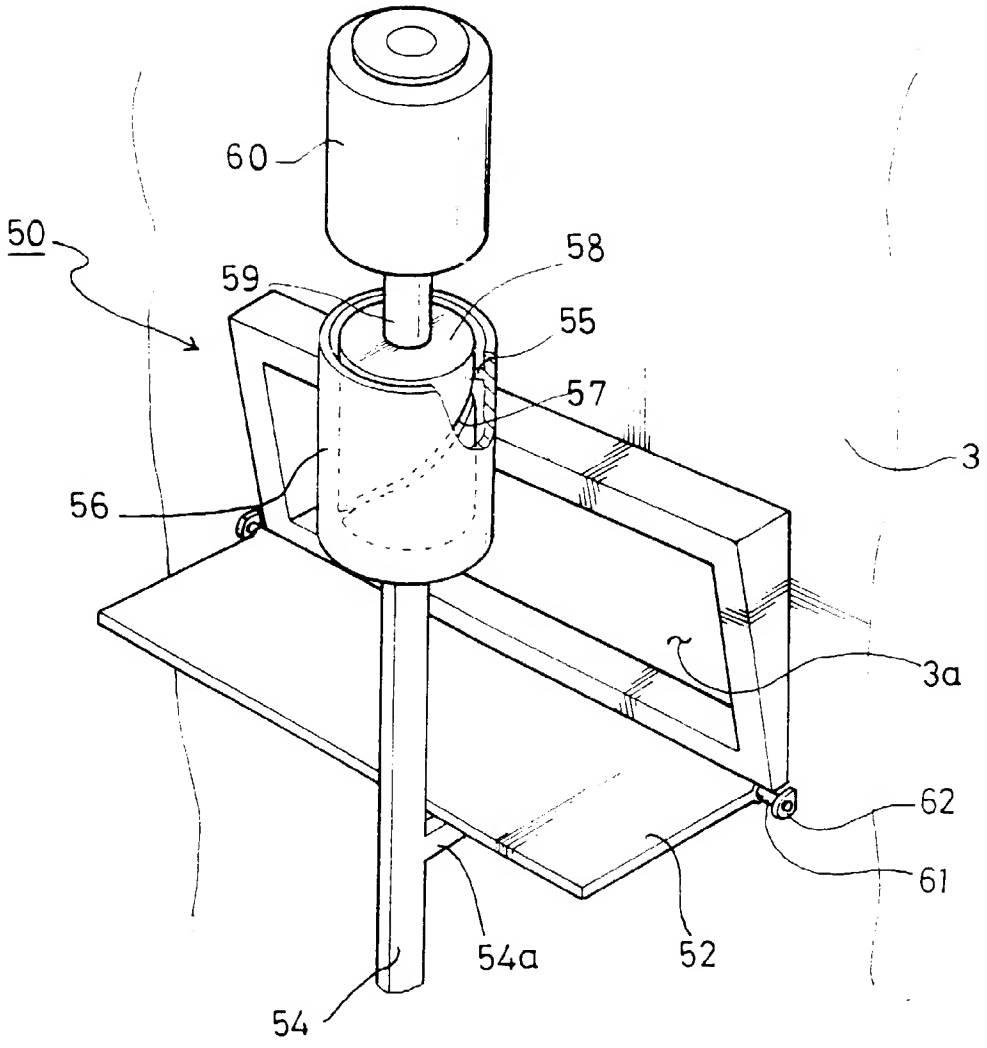

FIG. 6